Survivors of Neonatal Insults

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English Summary

Neonatal insults (NNI) are common causes of child mortality and adverse neurodevelopmental outcomes globally. Studies in developed countries have reported that children who survive NNI are likely to develop adverse long-term neurocognitive outcomes, including intellectual disability, hearing difficulties, and cognitive delays.

Millions of children in sub-Saharan Africa (SSA) experience birth complications and severe illness in the first 28 days of their lives. These complications include conditions such as neonatal jaundice (yellow coloring of the skin) and hypoxic-ischemic encephalopathy (inadequate oxygen or blood flow in the brain), which are likely to injure the child's brain and affect their development.

Despite the significant burden of disease, there is a lack of research documenting adverse long-term outcomes (particularly neurocognitive, educational, mental health, and quality of life outcomes) associated with neonatal jaundice (NNJ) or hypoxic-ischemic encephalopathy (HIE) in SSA. Additionally, less is known about the sources of variability in outcomes among children who have survived NNI. The lack of empirical data is a major barrier to developing appropriate services for these children.

Although the standard treatments of NNI such as NNJ are well established, less is known about the effectiveness of such treatment in SSA. It is essential to establish the efficacy of treatment especially in SSA as the developmental outcomes of survivors of such conditions may be exacerbated by inadequate or poor or delayed medical care and treatment received during hospitalization, and poor parental care.
In this thesis, I examined the long-term impact of NNI, the treatment outcomes of NNJ and the short-term and long-term developmental outcomes in survivors of NNJ or HIE. Additionally, I utilized the bioecological model to examine the underlying factors associated with long-term outcomes of survivors of NNJ or HIE.

In chapter 2, I conducted a systematic review and meta-analysis to examine the long-term impact of NNI globally. In this study, I found that there are limited studies, especially from low-and middle-income countries on the long-term outcomes of NNI. Nevertheless, among identified studies, I observed that there was a high prevalence of neurodevelopmental impairment in school-aged children and older groups of survivors of NNI. These findings provided a background to the empirical studies conducted in the Kilifi samples.

In chapter 3, I present results of an RCT which evaluated the efficacy of a therapy comprising a 20% albumin infusion in neonates with severe NNJ referred to the Kilifi County Hospital, situated at East Coast of Kenya. The findings revealed that the use of 20% albumin infusion as a treatment for NNJ is not superior to standard care (phototherapy and saline). Survivors of NNJ who were treated with 20% albumin had comparable outcomes to those treated with normal saline in reduction of total serum bilirubin, the need for exchange transfusion, mortality during phototherapy, and neurological impairment at discharge.

In chapter 4, I examined the developmental outcomes at 12-months in infants who had survived NNJ and explored whether neonatal sepsis aggravated the poor outcome in survivors of NNJ. The results of this study indicate that compared to their unaffected peers, survivors of NNJ had lower scores in language functioning, psychomotor functioning, and socio-emotional functioning. However, sepsis did not aggravate the poor outcomes associated with NNJ. Additionally, I found that survivors of NNJ who are born at home or those whose mothers are attended to by an unskilled birth attendant; had a mother with a low level of education, and babies who are not able to breastfeed moments after birth are likely to have poorer developmental outcomes.

In chapter 5, I conducted a cross-sectional study to screen and identify school-aged children without severe disability who were later assessed on the domains of comprehensive neurocognitive functioning, educational outcomes, mental health and quality of life (QoL) in a subsequent study. The results of this study show that that children without severe disability who survived NNJ and HIE have normal vision, hearing, motor functioning, and communication functioning. However, unlike the survivors of NNJ who also had normal cognitive functions, survivors of HIE had poorer cognitive outcomes compared to a normative group.

In chapter 6, I assessed a broad array of neurocognitive functions including nonverbal intelligence, planning, working memory, visual attention; language functioning such as syntax, pragmatics, and word-finding; and educational outcomes namely mathematical skills and reading skills in school-aged survivors of NNJ or HIE. Additionally, I was keen to find out the underlying factors associated with the neurocognitive and educational outcomes. The results of this study suggest that the NNJ group had poorer scores in word-finding, memory, and reading skills compared to the unexposed comparison group. In contrast, the survivors of HIE scored poorly on the language (syntax, pragmatics, and word-finding) and perceptual-motor tests than the unexposed comparison group.
Moreover, I found that neurological problems after discharge were associated with several poor outcomes in NNJ. At the same time, stunted growth was the main factor associated with almost all the outcomes in HIE.

In chapter 7, I investigated mental health outcomes and QoL of school-aged survivors of NNJ and HIE compared to an unexposed comparison group and the factors associated with these outcomes. I found that the survivors of NNJ and HIE have comparable levels of emotional and behavioural problems and QoL functioning as the unexposed comparison group. Poor maternal mental health was associated with elevated mental health problems as well as with lowered QoL in both survivor groups.

In summary, the findings of the thesis suggest that survivors of NNJ or HIE are likely to have poor developmental outcomes which not only manifest early in life but also continue in the school-age period. The poor developmental outcomes are associated with poor socioeconomic and perinatal variables, which may be amenable to intervention. These findings have important implications for intervention and research focusing on developmental outcomes in children who survived NNI.

First, given the high mortality of neonates with NNJ or HIE, there is a need to strengthen and improve the treatment and care of children affected by NNJ or HIE. Therefore, policymakers and health stakeholders should ensure that hospital services are affordable, accessible, and equitable (universal health care) so that the populace can utilize them. Second, there is a need to develop programs that build parental skills on how to promote reading skills or solve mathematical quizzes with their children to improve their children's school outcomes. Moreover, children with different learning difficulties (e.g. language, speech, and cognitive problems) can benefit from specific interventions in school that provide support for their learning process.

Third, it is vital to have community-based mental health programs incorporated to screen and refer mothers with mental health problems to the hospital for care and treatment. Fourth, there is a need to facilitate a healthy environment in families by encouraging fathers to be involved in parenting as mentally healthy fathers are likely to foster a healthy environment for parenting and model positive behaviors in their children.

Fifth, there is need for future use of advanced technology such as EEG, or CT scans in the clinical assessment of neonatal assessments as these may be useful to monitor and evaluate neonates who survive NNI. Lastly, there is a need for future longitudinal research or experimental designs to test transactional models that explain causality between NNI and neurodevelopmental outcomes or bidirectional associations between the underlying factors and poor developmental outcomes.